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ABSTRACT

This paper looks at using descriptions of subject matter content to assist in the development and interpretation of student performance on the National Assessment of Educational Progress (NAEP). These descriptions of content, called achievement level descriptions (ALDs), were initially conceptualized as exemplary statements of the knowledge and skills students should have at the various levels. Gradually, over the past decade the descriptions have evolved into comprehensive, rather than exemplary, statements of assessment content that must reflect the subject matter item pools to ensure consistency. This paper traces the policy development of the ALDs, discusses the various approaches to developing the ALDs over the past 10 years, and reviews the form and function of the ALDs in the current NAEP context. The paper suggests that ALDs should be retained and that they play an important role in shaping the end results from the NAEP and providing replicability in the process. The ALD process seems to be working; however, the ALDs may not serve the reporting function very well. Several approaches could remedy this weakness to help make NAEP results understandable for the U.S. public. (Contains 18 references.) (SLD)

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Setting Student Performance Standards: the Role of Achievement Level Descriptions in the Standard Setting Process

Mary Lyn Bourque
National Assessment Governing Board

Paper presented at the NCME Annual Convention,
New Orleans, LA, April, 2000

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Setting Student Performance Standards: the Role of Achievement Level Descriptions in the Standard Setting Process

Mary Lyn Bourque
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Introduction

This paper, based on ten years of experience with the National Assessment of Educational Process (NAEP), takes a closer look at the role of using descriptions of subject matter content to assist in the development and interpretation of student performance on the National Assessment. Initially, these descriptions of content, called achievement level descriptions (ALDs) were conceptualized as *exemplary statements* of the knowledge and skills that students *should know and be able to do* at the various levels (NAGB, 1990). Such statements were also used in earlier NAEP reports to interpret the cut scores (student performance standards) on the NAEP scale. The standards, called achievement levels, consist of three levels, *Basic*, *Proficient*, and *Advanced*. In reporting student performance on NAEP, the descriptions are exemplary statements of what students at a particular level are *likely to know and be able to do*. This distinction between what students 'should know' and what students demonstrate they 'do know' on the NAEP assessment led to some controversy over the precise meaning of the ALDs. Gradually over the past decade the descriptions have evolved into *comprehensive* rather than *exemplary* statements of assessment content that must reflect the subject matter item pools to ensure consistency between the two.

This paper will trace the policy development of the ALDs, discuss the various approaches to developing the ALDs over the past decade, and review the form and function of the ALDs (and various derivations) in the current NAEP context.

Evolution of NAEP Policy Definitions of the Standards

Lurking behind the ALDs are something called policy definitions, statements of the evidence of student achievement for each level that are independent of grade and subject matter content. The policy definitions, originally formulated by the National Assessment Governing Board (NAGB, 1990), were designed to lay out broad expectations for students

performance, for example, *Basic* signaled *partial mastery, Proficient* was *competency over challenging subject matter*. The initial policy statements were elaborate (in the absence of ALDs they needed to be), and worse yet, they included statements of prediction, none of which could be substantiated by cross-sectional data. For example, some of the initial policy definitions included statements like "[students at the Proficient level] are well prepared for the next level of schooling." Further, the initial ALDs were not well-balanced with respect the amount of detail, having far more at grade 12, and substantially less at grades 4 and 8.

These initial policy statements were sorely criticized by various groups, including the National Academy of Education, the NAEP Technical Review Panel, and other well-known researchers and evaluators (Burstein et al, 1996; Koretz & Deibert, 1995; Linn et al, 1991; NAE, 1992; NAE, 1993a; NAE, 1993b; NAE, 1996; NAE, 1997). Consequently, in 1993 they were revised. The newer versions were streamlined having no predictive statements, were fully balanced applying to all grades and subjects equally well, and tapped into the cognitive processes related to the levels. However, they are quite demanding in their expectations of what students should know and be able to do. See Figure 1 for a summary of the current statements.

Insert Figure 1 about here

There are some that claim that the policy definitions drive the high standards on NAEP. They argue this because it is the policy definitions that become operationalized into the ALDs. Defining *Proficient* as "competency over challenging subject matter" drives the ALDs into the higher ranges of subject mater content and thus the higher ranges of mastery.

Evolution of NAEP Achievement Level Descriptions (ALDs)

The use of ALDs in standard setting in general was not common in 1990. As a matter of fact in the 1990 NAEP initiative, there were none (Hambleton & Bourque, 1991). Panelists were required to translate policy definitions directly into cut scores on the NAEP scale without benefit of the intermediary steps of using grade- and subject matter-appropriate descriptions of content. Subsequent to developing the cut scores, descriptions were derived for reporting purposes by examining the items that anchored on the scale at or

around the cut score, and generalizing to statements of content for the grade and achievement levels. These descriptions were akin to the anchor descriptions developed for NAEP reports in the mid-to-late 1980s.

However, starting with the 1992 standard setting, based on lessons learned from 1990, the use of ALDs with the standard setting panels became standard operating procedure. The timing of the development of ALDs has varied from cycle to cycle. Figure 2 displays the relationship between early and current policy definitions, the NAEP cycle involved, and how and when the ALDs were developed for that specific cycle. Starting in 1992 NAEP has always used ALDs in developing the standards. However, for mathematics and reading (1992), they were developed by the standard setting panels at the beginning of the process, and refined throughout the process (ACT, 1993a; ACT, 1993b). This was not the ideal situation since it took several days to train panelists to the point where they could craft statements based on the assessment framework and the item pools. Thus, it took time away from the real task of developing the cut scores and selecting exemplar items. On the other hand, having the panelists develop the ALDs gave them a "buy-in" to the whole process, as well as an understanding of the framework and item pools that was valuable as they worked through the rating process for setting the levels.

Insert Figure 2 about here

However, NAGB felt that the wrong chronology was being used. In other words, the 'standards' (namely, ALDs) should be set first, and then cut scores developed to reflect the content standards. So starting in 1994, preliminary achievement level descriptions (PALDs) were crafted by the consensus panels that develop the assessment framework. Who better knew the content and what students *should know and be able to do* than the panels who were developing the content of what was going to be assessed? The PALDs were preliminary because they would serve to delimit the domain and the assessment content, and act as guides for the item writers. In addition, it was likely that some content identified in the PALDs might not be included in the final selection of items on the assessment. Therefore, having preliminary descriptions provided some flexibility later on.

In the U.S. history and world geography assessments (1994) the PALDs were given to the achievement level setting panels to finalize during the standard setting process (ACT,

1994a; 1994b). This procedure still required enormous amounts of time and training. Panelists needed to fully understand the assessment frameworks and have good familiarity with the item pools before attempting any modifications of the PALDs. Consequently, even though this approach was an improvement over previous NAEP cycles, it was not the final answer.

Therefore, in civics and writing (1998) yet a third procedure was devised to move from policy definitions to preliminary achievement levels descriptions to final achievement level descriptions (ACT, 1997a). The 1998 process simply removed the task of developing the ALDs from the standard setting panels altogether. Prior to the level setting in 1998, content panels were brought together to examine the public comments from a broad review of the PALDs. The review was conducted via the Internet and focus groups. The content experts took the comments into account and revised the statements for clarity, accuracy, and media appeal. These finalized ALDs then became *given*s to the standard setting process, much like the item pool and the frameworks are *given*s. We had anticipated a lack of commitment to the ALDs simply because the panelists had no part in their development. However, out fears proved unsubstantiated in the long run.

I will comment only briefly on the 1996 science process for the sake of completeness. The original ALDs were developed identically to the 1994 process, with PALDs coming out of the framework consensus group, and ALDs developed by the standard setting panels (ACT, 1997d). However, in the end, the cut scores developed by the panels were rejected by NAGB. Therefore, the ALDs and the NAGB-selected cut scores did not reflect each other and could not be used in reporting the results of the 1996 NAEP science assessment. Subsequently, new sets of ALDs were developed to reflect the NAGB cut scores using a scale anchoring procedure.

There is one more variation of these descriptions that plays a role in the level setting process, namely, Borderline Descriptions (BDs). The PALDs and ALDs always describe *what students should know and be able to do* whose performance is in the range being described. So, for example, the *Basic* achievement level description outlines the content expectations for students whose performance is in the range from the Basic cut score on the scale up to the Proficient cut score. Similarly, the Proficient achievement level description outlines the content expectations for students whose performance is in the Proficient range, i.e., from the

Proficient cut score up to the Advanced cut score. Figure 3 displays the relationship between the ALDs and BDs on the NAEP scale.

Insert Figure 3 about here

However, in training panelists to rate items and set cut scores, it is very necessary for them to think about the borderline performance of examinees, that is, what is it that students just need to know to move from one level up to the next? Obviously, if the ALDs represent a range of performance, the borderline performance will be a subset of that full range. These are what are called *Borderline Descriptions* (BDs) in NAEP. Borderline descriptions have been used in the NAEP process since the 1996 science effort.

In the NAEP process the BDs are developed by the standard setting panelists after having extensive training and developed an understanding of the assessment, the framework, the item pools, and most especially, the achievement level descriptions. The BDs are developed in grade groups and are used by the panelists in providing their item ratings.

The Form and Function of Achievement Level Descriptions

In the earlier sections of this paper the author has reviewed several iterations of statements of content that are important in the level setting process. There are policy definitions, preliminary descriptions, final descriptions, and borderline descriptions. All of this played out in the role of the ALDs in the various subject area standards development. Throughout this evolution, the descriptions have played a variable but critical role in developing and validating the levels. Each set of descriptions has a form and one or more functions in the process. The remainder of this paper will focus on the ALDs and detail the relationship between form and function.

The current ALDs are dense statements of content expectations. They have a heavy curricular bias in their language, are frequently replete with jargonese, and represent generalizations from the assessment framework and the item pools. That is their form, and this characterization is especially true of the early ALDs, including reading, mathematics, U.S. history, world geography, and science. It is somewhat less true of the current ones in civics and writing. In developing the recent sets of descriptions attempts were made to have

them reviewed by media experts who improved the public appeal of the language and made them more generally accessible to the NAEP readership.

What is the function of the ALDs? Their most important function is to provide a mental framework or structure for standard setting panelists. It is critical for all panelists to have a common understanding of the meaning of *Basic, Proficient,* and *Advanced.* Since the ALDs are derived to reflect the NAGB policy definitions, it is essential that during the process that panelists keep focused on the policy levels established by NAGB. The ALDs assist in achieving that focus. See Figure 4 for an example of the grade 8 mathematics ALDs.

Insert Figure 4 about here

Further, other ALD functions include assisting panelists in rating the items in the item pool. The ALDs assist in aligning the expected content with the ratings assigned to items by panelists. In addition, since all panelists are using a common filter or screen through which to view the items, achieving consistency from level to level, and, in some cases, across grades, becomes a possible goal. Finally, the ALDs assist panelists to internalize the meaning of *borderline performance* in the standard setting process.

These are the current functions of the ALDs, but are there additional desired functions? The answer is a resounding yes. The NAEP achievement levels are reported as a package, that is, there are verbal descriptions of content (ALDs), there are exemplar exercises taken from the assessment itself, and there are the cut scores. In addition, the NAEP reports provide the percentages of students in the nation and the states who have attained the *Basic, Proficient,* and *Advanced* levels.

However, for too many NAEP reports, the ALDs have come up short in terms of reporting to the public on NAEP results. The curricular language of the current form is not understood well by those outside the curriculum area. The ALDs do not help to interpret the NAEP performance levels (cut scores) to the American public, nor do they provide the public press and media outlets with a clear understanding of what it means to perform at the *Basic, Proficient,* or *Advanced* levels. There is, for example, no known case where the media

have printed the ALDs in part or in whole as part of the press release on NAEP results.[1] The ALDs were originally intended to serve as a supplement to the exemplar exercises in explaining what students know and can do in NAEP. It is the author's view that they have failed in this regard.

Summary and Conclusions

Where do we go from here? Should NAEP abandon the use of the ALDs and other variations thereof? It is the author's contention that the ALDs as such should be retained in the process. They play such a critical role in helping to define the standards that to drop them would be to place the procedural validity of the entire process at risk. Although we have no firm empirical evidence in this area, the data that are available from pilot studies and operational settings would suggest that the ALDs play a vital role in shaping the end results and providing replicability in the process. In several subject areas we have seen very similar results between the pilot cut scores and the operational cut scores, suggesting that such consistency did not happen by accident (see for example the results in the 1996 science, ACT 1997b; ACT, 1997c; and ACT 1997d).

After a decade of trying, the process seems to be about right (see Figure 5). NAGB sets the policy definitions up front. These in turn are given to the framework consensus panels to operationalize in terms of a specific grade level and content area on a preliminary basis. The preliminary statements are then widely reviewed by a variety of NAEP audiences, including other content specialists, stakeholders (e.g., SEAs and LEAs), NAEP users (e.g., teachers, administrators, policymakers, parents, etc.), and others. The reviews are incorporated into a revised version which NAGB approves before the standard setting panels use them to develop their recommendations on cut scores and exemplars. Finally, the whole package, i.e., cut scores, descriptions, and exemplars, goes back to the policymaking body, NAGB, for approval and adoption.

[1] A review of over 400 press clippings from 1990 through 1999 of NAEP results has shown no releases where the ALDs were re-printed by the media.

Insert Figure 5 about here

That being said, however, still leaves the plaguing question of whether or not the ALDs serve the reporting function very well. It is this author's contention that they do not. The appropriate solution to this dilemma is not clear. There are a number of approaches that could be used. One approach is to "tinker" with ALDs and re-write them for reporting purposes. The author strenuously disagrees with this approach. First, the re-writes are subject to the vagaries of language, and may or may not reflect faithfully the ALDs adopted by NAGB. Second, if the ALDs are "official" descriptions of the standards, what are the re-writes, "unofficial?" How will the public for whom the reports are intended untangle the official interpretation from the unofficial? Third, there are three descriptions for each grade, and nine across the subject area. Re-writes would lead to 18 descriptions, an unwieldy count by any standards.

Another approach is to capitalize on the exemplars for helping to describe the kinds of knowledge and skills that examinees are likely to know and be able to do on NAEP. The reporting function of the descriptions is to assist in the interpretation of NAEP performance. The exemplars seem to do this quite well. It might be possible to extract from the exemplar exercises the knowledge and skills students must have in order to answer the exemplar correctly. This would be a fairly focused statement of knowledge and skills, deriving solely from a single item, but would help to clarify the interpretation. Such exemplar-derived statements would not be as comprehensive as are the ALDs, nor would they be generalized statements as were the scale anchor descriptions. But if examinees are indeed answering the exemplars correctly, then such statements do assist in interpreting the NAEP performance. See Figure 6 for an example of this approach.

Insert Figure 6 about here

Another approach to helping the reader of NAEP reports to interpret the results is to simply provide them a collection of exemplars that are likely to be answered correctly by examinees whose performance is in the *Basic* range or the *Proficient* range. In the standard setting process we provide such lists of exemplars to panelists for them to select the most appropriate exemplars (space limitations preclude printing a full display of all exemplars in

NAEP reports usually). Providing the reader with the whole list could be quite helpful. Figure 7 is an example this approach, and was used in the 1996 NAEP science report produced by NAGB.

Insert Figure 7 about here

It is the conclusion of this author that much more work needs to be done in the area of using the ALDs as verbal interpretations of the NAEP results. In attempting to answer the question, "What do fourth graders know who are performing at the Proficient level?" there are three (or four depending on how you count) approaches one might take. One is numbers. Scale scores and cut scores on the NAEP scale just do not have any intuitive meaning to the American public. They seldom are reported by the public press as a means of "telling the story" about student performance. A second approach related closely to numbers is graphical displays. These seem to work – sometimes -- depending on the level of sophistication of the display and the reader. The media to report comparative state-by-state performance on NAEP occasionally uses graphic displays. The third approach is test items. These seem to work best, but are in limited supply, and are never re-printed in their entirety by the media. The fourth approach is words, and this returns us to the ALDs.

My final advice is proverbial -- don't throw the baby out with the bath water. NAEP should keep the ALDs since they function well in the standard setting process and are a critical part of that process. However, NAEP needs to work hard on fixing the reporting and interpretation of NAEP scales problem. NAEP is for the American public and, at one level, should be as understandable as your hometown newspaper, the Dow Jones Industrial average, or the Consumer Price Index. This lack of understanding is not a new problem created by the use of standards in reporting the NAEP results. However, the audiences for NAEP reports have changed and expanded in recent years. This is cause for celebration and concern. More research needs to focus on how best to get the message out to NAEP's new and expanded audiences.

References

ACT. (1993a). *Setting achievement levels on the 1992 National Assessment of Educational Progress in reading: Final Report.* Iowa City, IA: Author.

ACT. (1993b). *Description of mathematics achievement levels process and proposed achievement levels descriptions.* National Assessment of Educational Progress in mathematics: Final Report. Iowa City, IA: Author.

ACT. (1994a). *Results of the 1994 U.S. history National Assessment of Educational Progress achievement levels setting pilot study:* Iowa City, IA: Author.

ACT. (1994b). *Results of the 1994 geography National Assessment of Educational Progress achievement levels setting pilot study:* Iowa City, IA: Author.

ACT. (1997a). *Developing achievement levels on the 1998 NAEP in civics and writing.* Iowa City, IA: Author.

ACT. (1997b). *Setting achievement levels on the 1996 National Assessment of Educational Progress in science: Final report, Volume I. Pilot Study 1.* Iowa City, IA: Author.

ACT. (1997c). *Setting achievement levels on the 1996 National Assessment of Educational Progress in science: Final report, Volume II. Pilot study 2.* Iowa City, IA: Author.

ACT. (1997d). *Setting achievement levels on the 1996 National Assessment of Educational Progress in science: Final report, Volume III. Achievement level setting study.* Iowa City, IA: Author.

Burstein, L., Koretz, D., Linn, R., Sugrue, B., Novak, J., Baker, E.L., & Lewis, E. (1996). Describing performance standards: Validity of the 1992 National Assessment of Educational achievement level descriptors as characterizations of mathematics performance. *Educational Assessment,* 3 (1), 9-51.

Hambleton, R.K. & Bourque, M.L. (1991). *The LEVELS of Mathematics Achievement, Vol. III.* Washington, DC: National Assessment Governing Board.

Koretz, D.M. & Deibert, E. (1995/1996). Setting standards and interpreting achievement: A cautionary tale from the National Assessment of Educational Progress. *Educational Assessment,* 3(1), 53-81.

Linn, R.L., Koretz, D.M., Baker, E.L., & Burstein, L. (1991). *The validity and credibility of the achievement levels for the 1990 National Assessment of Educational Progress in mathematics.* Los Angeles, CA: Center for the Study of Evaluation, University of California.

National Academy of Education. (1992). *Assessing student achievement in the states.* Stanford, CA: Author.

National Academy of Education. (1993a). *Setting performance standards for student achievement.* Stanford, CA: Author.

National Academy of Education. (1993b). *The trial state assessment: Prospects and realities.* Stanford, CA: Author.

National Academy of Education. (1996). *Quality and utility: The 1994 trial state assessment in reading.* Stanford, CA: Author.

National Academy of Education. (1997). *Assessment in transition: Monitoring the nation's educational progress.* Stanford, CA: Author.

National Assessment Governing Board. (1990). *Setting appropriate achievement levels for the National Assessment of Educational Progress: Policy framework and technical procedures.* Washington, DC: Author.

Figure 1

NAGB Policy Definitions

- Proficient

  This level represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject—matter knowledge, application of such knowledge to real world situations, and analytical skills appropriate to the subject matter.

Figure 1 (continued)

NAGB Policy Definitions

- Basic

  This level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.

- Advanced

  This level signifies superior performance

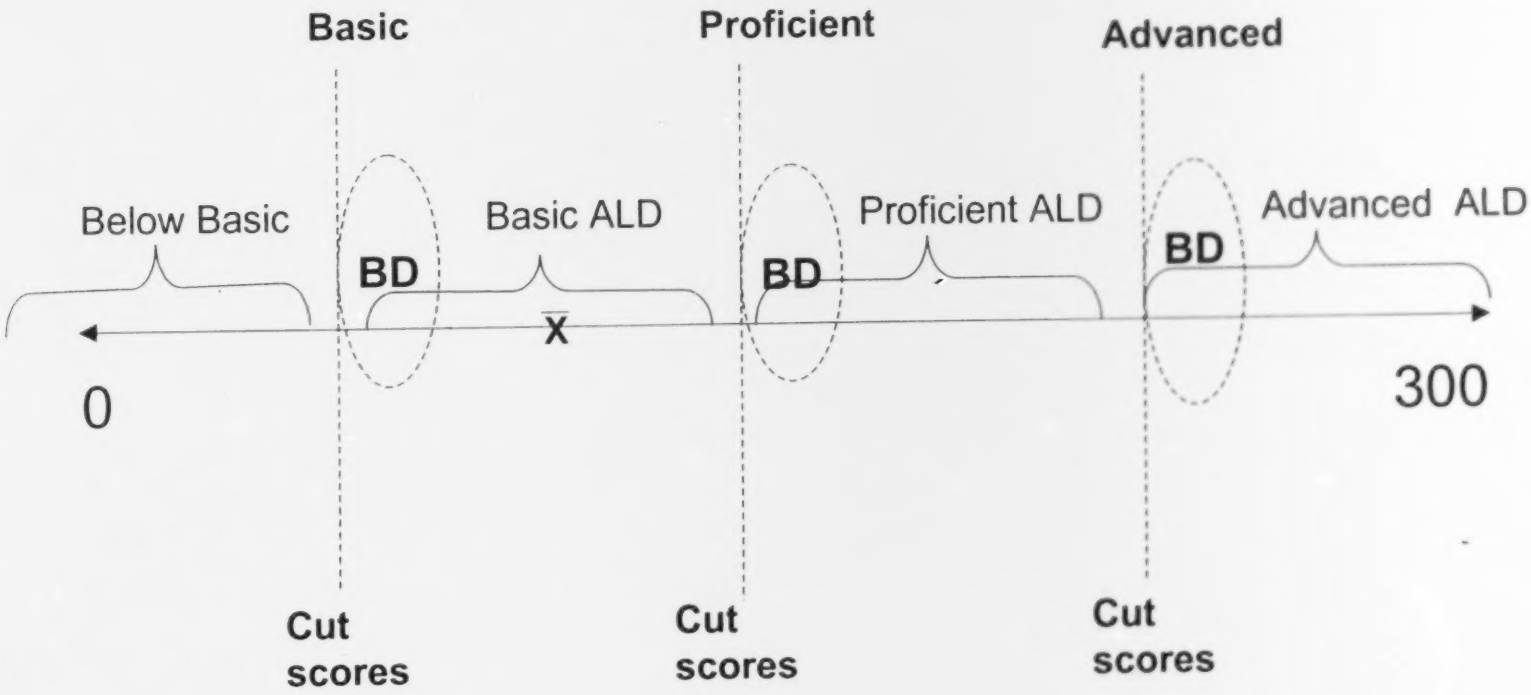
Figure 2

Relationship of Early and Current PDs and the Evolution of ALDs, 1990-1998 NAEP cycles

Policy Definitions (PDs)	Achievement Level Descriptions (ALDs)	How/When ALDs Developed
Early PDs (1990-1992) • Elaborate • Statements of prediction • Not balanced • Criticized by NAE, NAEP-TRP, RAND, etc.	Math, 1990 →	• After standard setting • For reporting purpose
	Math, 1992 Reading, 1992 →	• During process by panelists • Revised by content specialists later
Current PDs (1994-1998) • Streamlined • No predictive statements • Fully balanced • Tap into cognitive processes • Hard to understand by general public • Linked to language in Goals 2000 legislation • Linked to Title Legislation • Model for state assessments • Model for some commercial tests	US History, 1994 World Geography, 1994 →	• PALDs by consensus panels • ALDs finalized by AL panelists
	Science, 1996 →	• PALDs by consensus panels • ALDs finalized by AL panels • Reporting ALDs developed by an anchoring panel to correspond to Bd-selected cutpoints
	Civics, 1998 Writing, 1998 →	• PALDs by consensus panels • ALDs by content panels (became a *given* in the AL process)

Figure 3

Achievement Level Descriptions and the NAEP scale



NAEP Scale 0-300 $\bar{X}$=150 SD=35

Figure 4

Description of Mathematics Achievement Levels for Basic, Advanced and Proficient Eighth Graders

The five NAEP content areas are (1) numbers and operations, (2) measurement, (3) geometry, (4) data analysis, statistics, and probability, and (5) algebra and functions. Skills are cumulative across levels – from Basic to Proficient to Advanced.

Basic 256	Eight-grade students performing at the basic level should exhibit evidence of conceptual and procedural understanding in the five NAEP content areas. This level of performance signifies an understanding of arithmetic operations – including estimation – on whole numbers, decimal, fraction, and percents.

Eighth graders performing at the basic level should complete problems correctly with the help of structural prompts such as diagrams, charts, and graphs. They should be able to solve problems in all NAEP content areas through the appropriate selection and use of strategies and technological tools – including calculators, computers, and geometric shapes. Students at this level also should be able to use fundamental algebraic and informal geometric concepts in problem solving.

As they approach the proficient level, students at the basic level should be able to determine which of available data are necessary and sufficient for correct solutions and use them in problem solving. However, these 8th graders show limited skill in communicating mathematically.

Proficient 294	Eight-grade students performing at the proficient level should apply mathematical concepts and procedures consistently to complex problems in the five NAEP content areas.

Eight graders performing at the proficient level should be able to conjecture, defend their ideas, and give supporting examples. They should understand the connections between fractions, percents, decimals, and other mathematical topics such as algebra and functions. Students at this level are expected to have a thorough understanding of basic level arithmetic operations – an understanding sufficient for problem solving in practical situations.

Quantity and spatial relationship in problem solving and reasoning should be familiar to them, and they should be able to convey underlying reasoning skills beyond the level of arithmetic. They should be able to compare and contrast mathematical ideas and generate their own examples. These students should make inferences from data and graphs; apply properties of informal geometry; and accurately use the tools of technology. Students at this level should understand the process of gathering and organizing data and be able to calculate, evaluate, and communicate results within the domain of statistics and probability.

Advanced 331	Eight-grade students performing at the advanced level should be able to reach beyond the recognition, identification, and application of mathematical rules in order to generalize and synthesize concepts and principles in the five NAEP content areas.

Eighth graders performing at the advanced level should be able to probe examples and counterexamples in order to shape generalizations from which they can develop models. Eighth graders performing at the advanced level should us number sense and geometric awareness to consider the reasonableness of an answer. They are expected to use abstract thinking to create unique problem-solving techniques and explain the reasoning process underlying their conclusions.

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Figure 5

Relationship of Policy Definitions (PDs), PALDs, ALDs, BALDs in Current NAEP Standard Setting

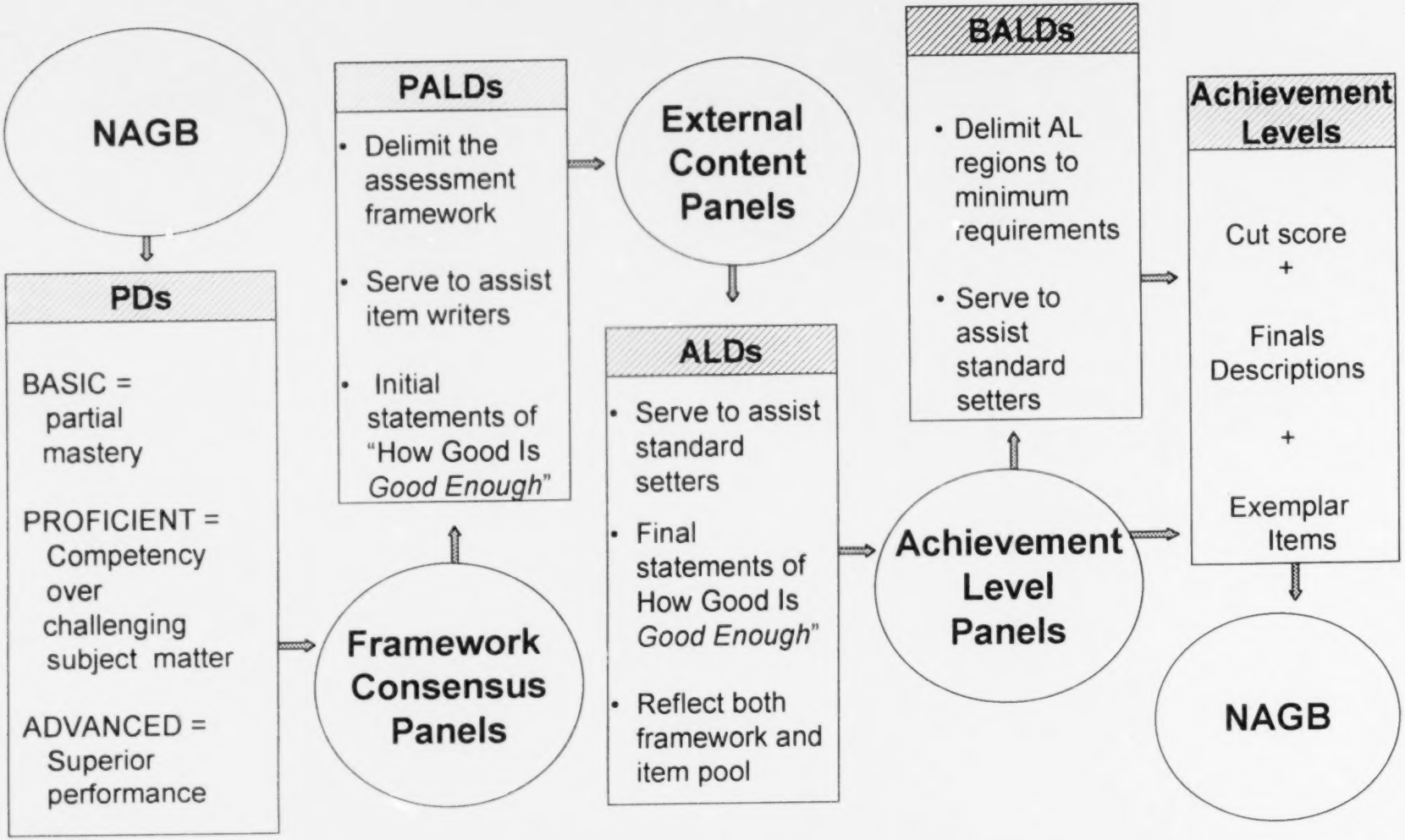

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Figure 6

Grade 12 Science Exemplars +

BASIC

1. Some students wee studying water in the environment. They filled one sample jar with ocean water and another sample jar with fresh water from the lake. The labels on the jars fell off, and the water in both jars looked the same. Describe a test, other than tasting or smelling the water, that the students could do to determine which jar held the lake water. Explain how the test would work.

   They could test the water for salt by letting the water dry up

This question measures the students' ability to plan a scientific test and to explain how the test would work. Students at the Basic level are likely to provide a method for the experiment, while the students at the Proficient level also provide its results.

Proficient

2. Coal is burned in a power plant that produces electricity. In a house miles away, a lightbulb is turned on. Describe the energy transformations involved.

   Coal being burned gives off heat, which gives off energy

   Compare the amount of energy released in one hour by burning the coal, the amount of energy received from the power plant in one hour by the house, and the amount of light energy produced in one hour by the lightbulb. Explain any differences among these three amounts of energy.

   The amount of energy released (in) 1 hour by burning the coal is much more than the amount of energy received from the powerplant in one hour than by the house which is more than the amount of light energy produced (in) one hour by the lightbulb. All this because each time is passes, loses energy.

Students at the Advanced level demonstrate a full understanding of energy transformations in technological systems and can explain differences among the energy transformations. Students at the Proficient level are likely to only provide one portion of the full response

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Figure 7

What Twelfth Graders Know and Are Able To Do In Science

Basic Level:

- Explain the composition, function, and definition of a gene
- Identify areas with temperate climate
- In a water cycle, determine the solid form
- Create a graph from a table of data about a pendulum
- Identify what a 100-power microscope can observe

Proficient Level:

- Recognize the evidence of a continental drift
- Determine the use of equipment when performing a separation
- Explain the activity at a ring of fire
- Explain the effect of mass on the period of a pendulum
- Describe ways of transmitting AIDS

Advanced Level:

- Determine the volume of oxygen, given certain conditions
- Design an experiment to test the effect of a plant on bugs
- Explain how to locate the center of an earthquake
- Explain a long-term solution to hunger
- Identify the cause of a change in the size of cells